

the physical conditions are adequately represented in this way.

He desires to find a solution when the period of the external disturbing force is the same as that of a free standing oscillation of the type of a seiche in a lake. For a seiche with a single central node the length of the tank must be equal to half the distance traversed by a long wave in the period of the external force. Thus the size of the tank is determined by the period of the external force and by the depth of the water. In the detailed treatment of the problem the depth is supposed to be uniform. Mr. Harris writes his equation of motion in the form of an equation of virtual work; he reverses the forces of inertia, adds them to the impressed forces and equates the virtual work to zero. Lagrange made the displacements arbitrary, and thus his equation of virtual work was exactly equivalent to as many differential equations of motion as there were variables; but Mr. Harris takes the displacements as proportional to the actual displacements per unit time and obtains a single equation. This is permissible, but the result cannot be anything but an equation of energy. I am unable to see any advantage in this procedure. He then assumes that the type of oscillation will be the same as in free oscillations, but this is surely a quite unwarrantable assumption. If the periodic forces have the same period as the free oscillation the oscillations will be large, but the type will in general be different. Does not this error vitiate his whole treatment of the problem? However, let us proceed. The type and period being the same as those of a free oscillation in the absence of friction, the periodic sustaining forces must exactly balance the frictions, and the frictional forces are proportional to the velocities. Now the motion being of the same type as in a free oscillation, the displacements are all simple harmonic functions of the time, and at any instant are all in the same phase. Hence the frictional forces, and therefore also the sustaining forces, are all in a phase differing from that of the displacements by a quarter period. Thus all the sustaining forces vanish at the instant when the displacement is a maximum, and we get nothing out of the equation of virtual work but what was put into it by dubious assumptions.¹

As a result of this discussion the following rule (p. 621) is given:—

"Project the force arrow" (of a number of tidal-force diagrams giving the direction and magnitude of the forces at various parts of the basin at successive hours) "belonging to the assumed time in each diagram upon the line of motion passing through it; the aggregate of the elementary masses, each multiplied by the intensity of the tidal force in the direction of the displacement, and again by a quantity proportional to the value of the maximum displacement (since the oscillation is harmonic), must be zero at the time of high and low water. The algebraic sum of these products for any given hour should be plotted as an ordinate at that hour. Where the curve thus constructed crosses the time axis denotes the time of high and low water."

Besides the objection to the proposition raised above in the case of the canal of uniform depth with synchronous disturbing force, I fail to see any adequate consideration of the variability of depth, of the absence of synchronism in the component disturbing force in the direction of the canal, or of the effects of the component transverse to the canal.

But even if it were possible to assent to this rule, it appears to me that there are other still more doubtful assumptions. On p. 624 we read:—

"Considering the actual distribution of land and water,

¹ A considerable portion of this criticism is due to Prof. Love, with whom I have had the advantage of discussing the matter. He points out, further, that Mr. Harris's equation (308), p. 619, which forms the key-note of the whole, is really identically satisfied by the assumptions.

a few computations upon hypothetical cases will suffice to convince one that as a rule the ocean tides, as we know them, are so great that they can be produced only by successive actions of the tidal forces upon oscillatory systems, each having, as free period, approximately the period of the forces, and each perfect enough to preserve the general character of its motion during several such periods were the forces to cease their action. This greatly simplifies matters. . . ." Undoubtedly the simplification is great, but is it true?

Then later:—"The paths of the particles being practically fixed and determined by the boundary conditions, it becomes possible to disregard the forces arising from the earth's rotation."

Now Lord Kelvin has concluded that "the oscillations of water in a rotating rectangular trough are not of the simple harmonic type in respect to form, and the problem of finding them remains unsolved" (*Phil. Mag.*, vol. x., 1880, p. 113). He has, however, solved the case of a rotating endless canal with straight sides, and adduces his results as probably dominating some remarkable characteristics of the tides of the English Channel. It seems to follow that either Lord Kelvin or Mr. Harris is wrong.

I gather that the free period of oscillation in the several basins into which the ocean is partitioned is the same as that of the tidal force. Now it is surely profoundly improbable that any large portion of our curiously shaped oceans should possess even approximately the critical free period, yet unless this is so the theory seems to be inapplicable. Finally, I think that the process of partition should receive an elaborate and critical discussion as to each basin; but I do not find that this is given in the book.

I can, in conclusion, only express a hope that I am not doing an injustice to Mr. Harris in dissenting so absolutely from his views. No one would have welcomed more warmly than I a new clue to our treatment of this difficult problem. I venture to express my admiration at the courage of the attempt, and although, as I think, it is a failure, yet it may inspire others to more successful attacks.

G. H. DARWIN.

NOTES.

THE hundredth anniversary of the birth of Abel, the great Norwegian geometrician, is on the point of being celebrated at Christiania. Representative men of science from many countries are expected to be present. The interest which His Majesty King Oscar II. has manifested in this centenary celebration is another proof of his continued sympathy with mathematical work and scientific research generally. It is announced that the Paris Academy of Sciences will be represented by M. Darboux and the Paris University by M. Émile Picard.

It is announced in *Science* that at a recent meeting of the corporation of the Marine Biological Laboratory at Woods Holl it was voted to transfer the Laboratory and its equipment to the Carnegie Institution. This action was taken after it had been stated to the members of the corporation that the executive committee of the Carnegie Institution would recommend to the trustees that the Laboratory should be accepted, that its debts should be paid, that new buildings should be erected, that 20,000 dollars a year should be allowed for maintenance and that the scientific management should rest as heretofore with the naturalists of the United States.

THE Cape Town correspondent of the *Times* states that great interest is being manifested there in the suggested visit of the British Association in 1905. As a preliminary measure, free passes on all the South African railways are promised for the

delegates, while the Colonial Governments will contribute 7000*l.* towards the expenses of the voyage and of the stay in South Africa.

A REUTER message from Barcelona, dated August 27, states that a severe storm has passed over Felanitz, Majorca, causing great damage in the town and district. The storm was accompanied by a downpour of rain. Several places were flooded and many houses were destroyed by lightning, by which several persons were killed. A south-easterly gale of exceptional violence was experienced on the southern coast of Cape Colony during Sunday evening, August 31, and Monday, September 1, causing much damage and loss of life.

THE following reports of eruptions and earthquakes have appeared during the past week :—*August 27.* A telegram from General Chaffee, the Commander-in-Chief in the Philippines, to the U.S. War Department, states that a series of earthquakes has occurred in Lake Linao country, in the Moro section of the island of Mindanao. The rivers and mountains have been considerably disturbed. Four hundred shocks have been felt since *August 21.* *August 26, St. Thomas.* A despatch received from Dominica at 6 p.m. reports that since two o'clock rumbling noises in quick succession have been heard from the southward, and that there is every indication that Mont Pelée is in violent eruption. *August 30.* A violent eruption of Mont Pelée destroyed Morne Rouge and Ajoupa Bouillon. About 1000 persons were killed and several hundred injured. A wave caused much damage at Carbet. A violent earthquake shock was felt at Carupano, on the coast of Venezuela, at 9 p.m. The disturbance was accompanied by a noise which was heard along the whole shore of the Caribbean Sea. *September 1.* The vessel which was sent to Tori Shima to report on the results of the volcanic disaster in that island in the middle of August has returned to Yokohama, and reports that Tori Shima is in a state of utter ruin. More than 150 lives were lost in the eruption, no one being left alive on the island.—A telegram from Castries states that Mont Pelée has been in constant eruption since August 15. There was an enormous fall of ashes on the night of August 25, and a very severe eruption on the night of August 28. Three eruptions occurred on the night of August 30, and it was impossible to reach St. Pierre from the sea.

AT the annual congress of the Royal Institute of Public Health, which concluded its sittings at Exeter last week under the presidency of the Earl of Iddesleigh, the necessity for teaching the principles of public health in rural districts was strongly urged, and the creation of a "Ministry of Public Health" advocated. Prof. Sims Woodhead directed attention to the need for further funds for the investigation of diseases such as cancer and tuberculosis, and pointed out what a good investment such expenditure would be as regards the national welfare. In the veterinary section, the deplorable condition of town and country stables and country cow-sheds and piggeries was alluded to by Mr. Eaton Jones in a paper on the "Veterinary Supervision of Domesticated Animals," and the meeting passed a resolution advocating the abolition of private slaughter houses, the appointment of veterinary inspectors of all animals intended for food, the inspection of dairies and cow-sheds, and the providing of suitable provision for the disposal of the carcasses of animals unfit for food. At a final meeting, Mr. Windley attempted to defend the course pursued by Leicester in its neglect of vaccination, and Dr. Millard suggested that the danger of the spread of small-pox supposed to arise from the presence of a large unvaccinated element in a community had been somewhat overrated. Prof. Smith pointed out that even in Leicester the hospital staff had been vaccinated, and that in the London small-

pox hospitals the staffs were subjected to compulsory vaccination and not a single case of small-pox had occurred among them; he believed that no one would attempt to establish a small-pox hospital and to officer it with an unvaccinated staff. The formation of a national water board, the new pharmacy bill and the construction of sanatoria for consumptives were the subjects of discussion in various sections.

PROF. VIRCHOW, who has been lying extremely ill at Harzburg, has been moved to Berlin, where he arrived on Saturday last. His strength is said to be unmistakably failing.

LORD CURZON, the Viceroy of India, has ordered the heads of the Veterinary, Survey, Forest, Meteorological, Geological, Agricultural and Botanical Departments of India to form a board of economic inquiry, which shall meet twice annually to formulate a programme and to review past work. The board is also to act as an advisory committee to the Government. The Royal Society has promised its assistance.

FROM the *Daily Mail* we learn that as a result of the last anti-tuberculosis conference held at Berlin a special organisation called the International Central Committee for the Prevention of Tuberculosis has now been established. The first meeting will be held under the patronage of the German Empress on her birthday, October 22, under the presidency of Prof. Von Leyden. Many prominent physicians from various countries will also be present. The organisation has already 120 members.

THE sixth annual week's fungus foray of the British Mycological Society will be held at Hereford, from Monday to Saturday, September 22–27.

THE following papers will be read in the Section of Physiology at the British Association in Belfast, in addition to those already mentioned (p. 377):—Prof. Symington and Dr. Cecil Shaw will show Edinger's drawing apparatus for higher magnifications and stronger light; the functions of the rods and cones of the retina, Mr. F. W. Edridge-Green; on the movements and innervation of the stomach, Dr. Page May; a new method for demonstrating chole hæmatin in ox-bile, Dr. W. A. Osborne.

THE *Patent Office Gazette* reports that patents on eleven different parts of wireless telegraphic apparatus have been granted by the U.S. Patent Office to Prof. Reginald A. Fessenden. Among the patents are included a device for signalling by magnetic waves, a current-actuated wave-responsive device, and also a conductor for wireless telegraphy apparatus.

A REUTER message from Ferrol states that on Friday last Mr. Marconi received a number of Spanish telegraphists on board the Italian cruiser *Carlo Alberto*. In the course of conversation, he stated that he was in daily communication with a receiving station near Plymouth and by this means had received news of the arrival of the King of Italy in Berlin. Referring to the prevention of interference of simultaneous messages, Mr. Marconi said that he was able recently to keep constantly in communication with England at the same time that men-of-war were communicating with each other and with the stations situated in the regions of the Hertzian waves.

A NEW York contemporary states that the De Forest system of wireless telegraphy has now been in practical operation for some months between New York and Staten Island. In this system, an antioherer of the electrolytic type is employed, its chief advantage lying in the fact that it requires no tapping back; a telephone is used in conjunction with this instrument, and the Morse signals are read by ear. The induction coil is eliminated from the sending apparatus, the spark being produced

by a pressure of 50,000 volts obtained by transforming up from the street mains. It is said that a speed of 25 to 30 words a minute is easily maintained. An instance is quoted of two messages having been read at the same time from the same receiver, one coming from an "outside" source, probably a Marconi station. This seems a doubtful recommendation for the system, and shows that the time can not be so very far distant when some consolidation of all the competing systems will be essential. It is to be hoped that this may result, not merely in the survival of the fittest, but in the evolution of a system possessing all the special advantages of the various competitors.

A NEWFOUNDLAND correspondent contributes a lucid and interesting article on "This Year's Arctic Work" to a recent issue of the *Times*. The preparations made for Baldwin's expedition northward from Franz Josef land, which has ended unaccountably in failure, are described with considerable detail, and the unusual completeness of Baldwin's equipment makes the return without substantial achievement all the more remarkable, especially in comparison with the results of the Duke of the Abruzzi's expedition. A short account of Peary's twelve years of Arctic work brings the extraordinary sufferings of that indefatigable explorer into strong relief, and the prospects of his success and safe return this year from what is to be his last Arctic journey are discussed. The safety of the expedition led by Sverdrup, captain of Nansen's *Fram*, which started from Jones Sound in 1899 to explore the vast unknown area beyond the Parry Islands and has not been heard of since, is already doubtful, and unless it returns this summer its position must be one of extreme peril, as it was only provisioned for three years. Should Peary and Sverdrup return safely this season, the Arctic regions will next spring be without a single investigator, a circumstance that has not occurred for more than fifteen years.

WE learn from the *Journal* of the Society of Arts that the Association of German Machinery Engineers of Berlin has offered prizes of 5000, 3000 and 2000 marks (250*l.*, 150*l.* and 100*l.*) for a constructive tracing of a locomotive able to pull a train of 180 tons in weight, on a level roadway, at a speed of 120 kilometres per hour (74.5 miles) for a continuous run of at least three miles, the highest rate of speed not to exceed 150 kilometres (93.2 miles) per hour. The close of the competition is fixed for December 1, 1902. Any further particulars may be obtained by applying to the secretary of the above association, Herr Geheimer Kommissionrath, F. C. Glaser, Lindenstrasse 80*l.*, Berlin.

OUR American contemporary *Science* protests strongly against the appointment of Captain Colby M. Chester, a naval officer without special knowledge of astronomy, as superintendent of the U.S. Naval Observatory. The institution is regarded as the national observatory of the United States, and the opinion is expressed that an astronomer should be at its head instead of a naval officer. Our contemporary adds: "The institution has no rational purpose of existence except a desire on the part of the American people that our nation shall, in its public capacity, do its full share in the promotion of those branches of astronomy which have to be pursued under public auspices. The leading position which our country has taken in the extraordinary development of astronomic science during our generation can alone justify the unparalleled expenditure of our Government upon its observatory. The results of this expenditure through the ten years since the completion of the new observatory should have been its general recognition as the leading observatory of the world in at least some important field of the sciences. With its great advantages over old-fashioned Greenwich and Paris, it should have left both these institutions in the rear."

M. DE FONVIELLE informs us that M. Camille Pelletan, Minister of the French Marine and of the Colonies, has placed the *Epée*, a torpedo destroyer, 306 tons, 62 men, at the disposal of Comte de la Vaulx for purposes of aeronautical manoeuvres on the Mediterranean, with a new balloon. It may be remembered that last year Comte de la Vaulx tried to cross the Mediterranean from Toulon with a large balloon made captive by floating pieces of wood. The experiment, although interesting, proved a failure, owing to the wind blowing eastward. This year the experiments are likely to begin from Palavas, a point near the place where, in 1901, the trip ended. The *Epée* is to join the balloon there on September 10. The new balloon will carry in its car a propelling petroleum engine, which, however, will be used only in the second series of manoeuvres. On Sunday, August 24, M. Heurreux, a young and promising aeronaut, tried on a smaller scale similar performances in the Channel. He proved by an ascent at Dunkerque that a tug-boat can conduct a balloon against a strong wind. The balloon *Alcor* was sent up in the direction of the sea and for some time was lost to view in the clouds; but, after having run some miles, the valve was opened and the balloon descended close to the waves. M. Heurreux dropped his cone-anchor and waited until a tug-boat, sent out especially from Dunkerque, threw a rope to the car, by which the balloon was tugged easily and reached Dunkerque fully inflated.

AT the annual meeting of the Société d'Encouragement pour l'Industrie nationale, the president announced the mode of distribution of the grants at the disposal of the Society for research work bearing upon industry. The gold medal of the Society for work which has exercised the greatest influence on French industry is awarded to M. V. Steinlen for his researches on the invention and construction of machine tools, M. Rabate receiving the Parmentier prize for his original studies on the resin industry. Money grants were also given to M. Fremont (3500 fr.) for his work on the testing of metals, to M. Gutton (3000 fr.) for his work on the fragility of materials, to M. C. Brioux (2000 fr.) for his geological and agricultural study of Basse-Bourgogne, to M. C. Urlwin (500 fr.) for his work on the acetylacetates, to M. Guyot (500 fr.) for his researches on colouring matters, and to M. Canovetti (1000 fr.) for his work on air resistance. The total amount of the grants for research made by the Society for the years 1902-1903 is twenty thousand francs. The president expressed the hope that the industries which benefit by this sacrifice will lend assistance in their turn in providing for the commencement of new studies which the Society has not as yet been able to attempt for want of sufficient funds.

ON the occasion of the recent meeting of the members of the British Pharmaceutical Conference at Dundee, the president, Mr. J. C. Druce, summarised in his address the progress of Scottish botany. The review begins with an account of the work of Robert Sibbald, who lived in the latter half of the seventeenth century and compiled the work known as "*Scotia Illustrata*." After him, the more important systematic botanists referred to are Dr. Lightfoot, the author of "*Flora Scotica*" (1777), Sir James E. Smith, whose "*English Botany*" is a standard work, George Don, famous on account of his botanical explorations (1800), Sir W. J. Hooker, who also published a "*Flora Scotica*" (1821), and Mr. H. C. Watson, to whom we are indebted for the "*Cybele Britannica*" (1847-1860). The most impressive part of the address is the vivid sketch of George Don, who, humbly born and poorly educated, devoted himself with untiring energy to scientific, more especially botanical, observations, and was the first to explore many Highland districts now famous, but at that time quite unknown. Owing to unfortunate circumstances, many of Don's discoveries have been called into question,

but later investigations tend to re-establish his reputation. There is no doubt that, owing to the fact that he sent out specimens from his garden, and that his references to localities were at times inaccurate, his records are not always trustworthy; on the other hand, some of his doubted specimens have since been re-affirmed, of which Mr. Druce mentions *Salix doniana*, *Triticum alpinum* and *Carex ustulata*. The concluding part of the address furnishes a list of species peculiar to Scotland, and an account of species characteristic of counties or districts.

Now that autumn is approaching, and it is time to be planting bulbs, those growers who require daffodils will be interested in the catalogue issued by Messrs. Barr and Sons. This firm has for a long time made a speciality of these flowers, and offers all varieties, from the inexpensive kinds suitable for planting in woodlands to the select and rare hybrids which require several years to raise from seed.

THE report on the St. Kitts-Nevis Botanic Station, for the year ending March 31 last, states that in August, 1901, an experiment with tobacco was successfully established on half an acre of ground. Plots were also started on four estates, advice and assistance being constantly given to those in charge, and the planters invited to witness each operation in progress. With seed procured from England, another attempt was made to cultivate potatoes, but the results went to show that instead of producing what we know at home as "new" potatoes, the crop when reaped was found to have precisely the flavour and conditions of old potatoes. For the purpose of destroying grasshoppers, an endeavour was made to acclimatise the Barbadoes blackbird. Several consignments of birds were received, but nearly all disappeared, a few being seen only in one or two places where they are regularly fed.

THE *Journal* of the Royal Microscopical Society for June contains an interesting paper, by Mr. C. F. Rousselet, on the genus *Synchæta*. Some of the members of this genus are amongst the commonest rotifers inhabiting fresh-water lakes and ponds as well as brackish tide pools and the open sea. Pastor Eichhorn (1761) and F. O. Müller (1786) are probably the earliest authors who have left sketches probably representing species of this genus; but our real knowledge of these rotifers dates from 1831 to 1834, when Prof. Ehrenberg described four species of *Synchæta*. Mr. Rousselet now records sixteen different species, of which five are new, viz. *S. kitina* (in fresh water), *S. littoralis* (in brackish water), *S. cecilia*, *S. vorax* and *S. neapolitana* (marine).

A NOTE by Prof. Garbasso, of Turin, contributed to the *Nuovo Cimento*, 5, ii., deals with a phenomenon observed by Prof. Manuelli, viz. the action of sunlight in facilitating the passage of electric sparks, an effect closely resembling, if not identical with, Hertz's phenomenon. Prof. Garbasso has made experiments which show that even diffused sunlight has a considerable effect. In one experiment he counted 24 discharges in 30 seconds in the light as against 8.8 in darkness; in another experiment the numbers were 18.1 and 6.3. The effect of the light seems to last for a certain interval after the illumination is cut off. Experiments were made first with a lens and next with a mirror used for concentrating the rays; and it was also found that when the light was brought to a focus on one of the electrodes, an uninterrupted current was obtained even at distances beyond the sparking distance in the dark, but the effect was greatest when the light fell on the negative pole. This influence of solar light is unaffected by the passage of the light through quartz or Iceland spar, but is destroyed by a few films of mica, a thick glass plate, or a vessel of water or alum solution 4 cm. thick. These results point to the view that the effect of Manuelli is due, not to the presence of ultra-violet rays, but rather to the heating of the electrodes.

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Bulletin No. 51 of the U.S. National Museum will be exceedingly useful to working naturalists, since it contains a list of the publications of that institution from the year 1875 to 1900, drawn up by Mr. R. L. Geare.

THE last issue of the *Transactions* of the South African Philosophical Society, comprising pp. 561 to 896 of vol. xii., is entirely devoted to a continuation of the valuable descriptive catalogue of the beetles of South Africa. A very large number of new species as well as some new genera are described in this fasciculus, the diagnoses of which appear to be well and carefully drawn up. We think, however, it would have been better had the dates been added in all cases to the references to previously named genera and species.

Science for August 15 contains a full report of a long address on the history of ichthyology, delivered by Prof. Jordan before the zoological section of the recent meeting of the American Association, held at Pittsburg. Commencing with Aristotle, the lecturer gives a full account of the gradual progress of our knowledge of recent and fossil fishes, in the course of which he allows full credit to the efforts of the earlier workers, especially Ardeï, whose list of genera is given at length. The British Museum catalogues of fishes, recent and fossil, receive a large share of commendation. Of one of these the lecturer speaks as follows:—"The chief criticism which one may apply to this work concerns most of the publications of the British Museum. It is the frequent assumption that those species not found in the greatest museum in the world do not really exist at all." We venture to doubt whether this sweeping criticism is deserved. Readers with a knowledge of British fish-literature will not fail to notice that the first appearance of Yarrell's work is misprinted 1859 (in place of 1839) in the report of the address.

In the August (third) number of the *Field Naturalist's Quarterly*, the editor devotes the opening paragraphs to a discussion of the present form of nature-teaching in schools, and the manner in which this may be improved. It is essential that the lessons should be simple and practical, and the author recommends that a child should be encouraged to watch and describe the life-history of a common insect, or the daily development of a flowering plant. Later on in the same number, Mr. R. Haines discusses the difficulties in connection with the establishment of an "Arbor-day" in this country. The main idea of such an institution is that on a certain day each inhabitant of a village or town should plant a tree; and the author very pertinently inquires who is to provide the trees and the land on which they are to be planted, and the kinds of trees to be selected. He might have asked who is to be responsible for the attention and care they will certainly require during the earlier years of their growth.

WE have received from Dr. H. Hergesell the year-book of meteorological observations taken in Alsace and Lorraine during 1898. For Strassburg, hourly or two-hourly readings are published, and the usual observations at ten stations of the second order. Rainfall summaries are given for fifty-eight stations.

THE eighteenth volume of observations made at the Hong Kong Observatory for the year 1901 has been published by Dr. Doberck. The comparison of the daily weather forecasts with the weather subsequently experienced shows, as in previous years, a large amount of success, the sum total (including cases of partial success) reaching 93 per cent. The useful work of collecting observations from ships' logs, for the construction of pilot charts for the eastern seas, has been vigorously continued; the number of entries in 10° squares available for each month of the year save two exceeds twenty thousand. The magnetic and astronomical observations have also been regularly carried on. In the year 1901, the number of transits observed was 3349.

WE have received from Prof. F. Omori the first portion of a memoir on macro-seismic measurement in Tokyo, containing the analysis of the diagrams of 220 earthquakes observed at three places in that city, mostly between September, 1887, and July, 1889. Prof. Omori defines the macro-seismic motion as that part of the earthquake-motion which consists of vibrations the period of which, except in very strong shocks, does not exceed two or three seconds. A discussion of the analysis will be given in the second portion of the memoir.

DURING the past year, we have received the nine parts forming vol. vii. of the *Bollettino* of the Italian Seismological Society for 1901-1902. The description of new instruments or of modifications of old ones is, as usual, a prominent feature of the volume. We have noticed already several of the papers, and need here only call attention to Prof. Mercalli's studies of Vesuvius from July, 1900, to the end of 1901, Prof. Riccò's paper on the central crater of Etna, and the valuable notices of earthquakes recorded in Italy during the year 1900.

THE Home Office has issued the annual report relating to persons employed and accidents at mines and quarries in the United Kingdom in 1901. It is edited by Prof. C. Le Neve Foster, F.R.S., and contains a large amount of interesting information. The total number of persons employed was 933,366. There were 1075 accidents, causing the loss of 1229 lives. Compared with the previous year, there was a decrease of 48 in the number of fatal accidents, but an increase of 52 in the number of lives lost. The general death-rate was 1.348 per 1000, as compared with 1.408, the average for the past ten years. Of the fatal accidents, 43.7 per cent. were due to falls of ground, 11.0 per cent. to explosions, 13.5 per cent. to surface accidents, 7.0 per cent. to shaft accidents, and 24.8 per cent. to miscellaneous accidents underground. The use of coal-cutting machinery does not appear to be making very rapid progress.

THE School of Mines of the University of Wyoming has issued a series of bulletins on petroleum, and of these No. 5 (June) deals with the Newcastle oilfield. Petroleum occurs in the Dakota shales and sandstones near the base of the Cretaceous, and it proves of value for lubricating and for fuel.

AN interesting account of the Darling Downs district in Queensland is given by the Hon. Arthur Morgan (*Proc. Roy. Geograph. Soc., Australia*, vol. xvii.). He dwells especially on the work of Allan Cunningham, who in 1827 discovered the Darling Downs, now regarded as one of the most fertile and healthful tracts, and also as a region of considerable geological interest, for it has yielded remains of remarkable fossil mammalia, gigantic in size compared with the recent representatives.

DR. HENRY WOODWARD contributes to the *Proceedings* of the Bath Natural History and Antiquarian Field Club (vol. x.) an interesting outline of the life of William Smith, the "father of English geology." It is accompanied by a portrait (reproduced from Phillips's "Life of William Smith"), by a photograph of the bust by Chantry, which stands in St. Peter's Church, Northampton, and by a view of the monument erected by Lord Moreton, at Churchill, in Oxfordshire, the birthplace of Smith.

IN some contributions to South African petrography (*Geol. Mag.*, August), Mr. Frederic P. Mennell, curator of the Rhodesia Museum, refers to the great development of basic lavas and acid plutonic masses. He describes examples of basalt, dolerite, gabbro, syenite, &c., that have been gathered from a wide area in Rhodesia, Bechuanaland and other parts of South Africa. The great granite mass of the Matopos, which forms the backbone of southern Matabeleland, closely resembles

the Dartmoor rock, but near Bulawayo it presents appearances of foliation which may be due to movement before complete consolidation.

SOME interesting details relating to the recovery of tin from tin-scrap have recently been published in the *Zeitschrift f. Elektrochemie*. In Germany, several works have been built and operated for carrying out this procedure, the largest of these being that of Goldschmidt, at Essen, where 50-60 tons of tin-scrap are reported to be treated per day. The difficulty of obtaining an adequate supply of raw material has hindered the development of other works, and the anonymous writer of the article we are discussing hints that the supply of tin-scrap is monopolised by one or two of the larger works. The processes used for recovering the tin are based upon the use of the scrap as anode material, in a bath containing sodium chloride and hydrate, or in one containing hydrochloric acid. The advantage of the former is that less iron goes into solution, but against this there is the lower energy efficiency of the process and the more spongy nature of the deposit obtained at the cathode. The failure to produce directly metallic tin is one of the chief difficulties in the operation of both processes, for considerable losses occur in smelting and refining the spongy deposit obtained at the cathode. Under certain conditions, metallic tin can be obtained in the electrolytic bath, and Pfannhauser, in the issue of the *Zeitschrift f. Elektrochemie* for January 16, has stated his opinion that the avoidance of the formation of sponge is simply a question of maintaining the concentration of the tin salt solution in the neighbourhood of the cathode. This condition would appear to be difficult to attain in the works treating tin-scrap on an industrial scale, and the problem of producing metallic tin at the cathode is complicated further, by the slow but gradual increase of impurities in the electrolyte. A new works for the treatment of tin-scrap has recently been built at Pfaffstätten, near Vienna, and an electrolytic process for recovering tin from slags is also reported to be in operation at Tostedt, in Germany. In this country we are not aware of any similar works in actual operation, but during 1901 a company was formed with a capital of 10,000*l.* to build and operate a works for the treatment of tin-scrap by a new electrolytic process. A plant for dealing with 50 tons of cuttings per month was to be erected, presumably near London.

MESSRS. WHITTAKER AND CO. will shortly publish a work on galvanic batteries, by Mr. S. R. Botton. The book will deal with the theory, construction and use of electric batteries, comprising primary, single and double fluid cells, secondary and gas batteries.

MESSRS. NEWTON AND CO. have sent us a copy of a useful catalogue of physical apparatus and accessories manufactured by them. In addition to numerous figures in the text, the catalogue has eight plates containing reproductions of photographs of typical instruments used for demonstrations in the lecture room and practical work in the laboratory. Among the apparatus described, we notice a cyanine prism for showing anomalous dispersion, circular diffraction gratings and photographic gratings, zone plates, new contact breaks, localising instruments for Röntgen ray work, apparatus for wireless telegraphy demonstrations, and for experiments with alternating currents of high tension and high frequency.

WE have just received the annual report of the Government Analyst at Trinidad. The report indicates that in addition to the examination of officially submitted samples, of which more than 2000 were received during the year, a considerable amount of valuable work is being done by the head chemist, Prof. Carmody, by investigation of the mineral deposits of the island. Experiments have also been made at the Government farm on the diurnal variation of cow's milk.

ACCORDING to the report of the principal chemist of the Government Laboratory for the year ending March 31, it appears that during the past twelve months the work of the Customs branch of the Laboratory has more than doubled in magnitude, the increase being due chiefly to the imposition by the Budget of April, 1901, of duties on sugar and cognate substances, and on the numerous articles in the manufacture of which these substances are used. More than 64,000 samples were submitted for test as compared with about 34,000 in the preceding year.

A CAREFUL experimental inquiry regarding the nutritive value of alcohol has recently been carried out in the chemical laboratory of Wesleyan University by Messrs. Atwater and Benedict, a report on which forms the sixth memoir of vol. viii., published by the National Academy of Sciences. The main question studied is the value of alcohol as a fuel in the human body and its comparison in this respect with sugar, starch, fats and other nutrients of ordinary food materials. Collaterally, the question of the effect of alcohol upon the proportions of nutrients digested from the food with which it was taken has also been examined. Metabolic experiments on an elaborate scale have been instituted with the view of investigating the problem, and no expense has been spared to obtain complete and accurate results, a large share of the costs having been borne by the Committee of Fifty for the Investigation of the Drink Problem. The results of the inquiry indicate that more than 98 per cent. of the ingested alcohol was oxidised in the body and that the potential energy of the alcohol was transformed into kinetic energy as completely as that of the ordinary nutrients. Alcohol appears to be very efficient in the protection of body fat from consumption, but not quite so efficient as the isodynamic amounts of the ordinary nutrients in the protection of body protein. The conclusion is drawn that so far as the utilisation of the total energy of the diet is concerned, there is a slight advantage in favour of the non-alcoholic diet, especially when the body is subjected to hard muscular exertion, but the difference is so small as to lie almost within the limits of experimental error.

The additions to the Zoological Society's Gardens during the past week include a Purple-faced Monkey (*Semnopithecus cephalopterus*) from Ceylon, presented by Miss M. Wheatcroft; a Bonnet Monkey (*Macacus sinicus*, ♂) from India, presented by Mr. C. F. Taylor; a Green Monkey (*Cercopithecus callitrichus*) from West Africa; a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. R. M. Drury; an Australian Sheldrake (*Tadorna tadornoides*) from Australia, presented by Mr. W. Jamrach; an Egyptian Monitor (*Varanus niloticus*) from West Africa, presented by Mrs. Mary A. S. Deacon; two Cocteau's Skinks (*Macroscoincus cocteau*) from the Cape Verde Islands, presented by Mr. F. Newton; two Axolotls (*Amblystoma tigrinum*) from North America, presented by Mrs. Millicent Summers; a Spotted Salamander (*Salamander maculosa*), European, presented by Mr. R. R. Green; a Common Snake (*Tropidonotus natrix*), British, presented by Mr. E. Crane; a Grand Galago (*Galago crassicaudata*, var.) deposited; a Black-necked Swan (*Cygnus nigricollis*, ♀) from Antarctic America, purchased; a Rufous-necked Wallaby (*Macropus ruficollis*), a Common Wallaroo (*Macropus robustus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

CATALOGUE OF NEW DOUBLE STARS.—Mr. W. J. Hussey publishes, in No. 21 of the *Lick Observatory Bulletin*, the fifth catalogue of one hundred new double stars which he has discovered with the 12-inch and 36-inch refractors of the Lick Observatory, all these doubles having distances less than 5".

Twenty-five per cent. of the five hundred pairs announced have distances not exceeding 0".50, 48 per cent. not exceeding 1".00, and 72 per cent. not exceeding 2".00. The average distance for the five hundred pairs is 1".52.

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HYPOTHESIS ON THE NATURE OF SOLAR PROMINENCES.—Prof. W. H. Julius has described before the Royal Academy of Sciences (Amsterdam) a theory as to the nature of solar prominences.

It may be remembered that Prof. Julius accounted for the doubling of the arcs in the spectrograms obtained by him during the last total solar eclipse, by saying that it was due to the anomalous dispersion of the chromospheric light, and he now applies this theory of anomalous dispersion to account for solar prominences. He abandons the idea of the existence of various layers of different materials in the solar atmosphere, and suggests that "throughout the gaseous body, as well inside as outside the critical sphere, the various elements are altogether intrinsically mixed (granting that in the mixture the quantity of materials with greater specific gravity must grow with the depth)." It is suggested that, in the whirls formed by the ascent and descent of heated gases combined with the rotational velocity of the solar atmosphere, we get anomalous dispersion at the points where two or more of these whirls intersect and break each other; and the author goes on to propose "that the whole chromosphere with all its prominences is nothing but this system of waves and whirls, made visible within shorter or longer distances from the sun's edge by anomalous dispersion of light, coming from deeper layers."

Prof. Julius also points out that this theory abolishes the necessity for supposing the immense velocities which Fényi and others have observed in connection with solar prominences, because it suggests that there is not a transmission of material, but only successive appearances of the same phenomena at various heights. He likens this to the apparent velocity of the line of foam caused by water waves breaking on a coast which is inclined to their wave-fronts (*Proceedings of the Royal Academy of Sciences, Amsterdam*).

VISIT OF THE ENGLISH ARBORICULTURAL SOCIETY TO COMPIÈGNE.

THE English Arboricultural Society held its annual meeting in London on Monday, August 18, and Mr. George Marshall, of Frimstone, Liphook, one of the members of the Royal Forestry Commission, was elected president for the year, in succession to Dr. Somerville, of the Board of Agriculture. M. Daubrée, Conseiller d'État and Directeur des Eaux et Forêts, was elected honorary vice-president, and four other French officers connected with the forests which were to be visited by the Society were elected honorary members.

On August 19, fifty-three members of the Society proceeded *via* Boulogne to Compiègne. Among these, besides our president, may be noted Mr. H. J. Elwes, F.R.S., of Colesborne, Gloucestershire; Mr. Coroner Graham, of Durham; Mr. F. W. Beadon, of Longley Hall, Huddersfield; Mr. J. Smith Hill, principal of the Agricultural College, Aspatria; Sir Hugh Beevor; Mr. J. Davidson, the secretary, in charge of the forests belonging to Greenwich Hospital; Mr. E. McA. Moir, late of the Indian Forest Department; Mr. Forrest, agent to the Duke of Bedford at Thorney; Mr. W. Forbes, forester to Lord Masham; Mr. Havelock, forester to Lord Yarborough; Mr. Gillanders, forester to the Duke of Northumberland; Mr. A. C. Forbes, forester to Lord Lansdowne, and many other foresters and nurserymen.

On August 20, the party proceeded to Villers Cotterêts (Aisne), the birthplace of Dumas, and spent the morning in inspecting the extensive timber yards of M. Carpentier and of the Chemin de Fer du Nord. The French band saws are the best in existence, and a very large quantity of fine beechwood is now being sawn up. The beech is sawn green during summer and then carefully seasoned, while oakwood is now being collected for autumn and winter sawing, hornbeam wood being sawn up in the spring. M. Carpentier sells much hornbeam wood in England. The system of creosoting by the Chemin de Fer du Nord is new. It is very effective, and was explained in detail and by practical illustration by the director. Large quantities of beech and oak sleepers are thus prepared, the beech absorbing three times as much creosote as the oak, and, as an experiment, a few maritime pine sleepers were being tried, this species not being yet used by this railway.

After breakfast, the party visited the Forêt de Retz (32,550 acres with a net revenue of 23,698*l.*), on undulating land 200 to 800 feet in altitude, the soil being chiefly a deep and fertile